CHAPTER 2 – SUPPLEMENTAL INFORMATION

2.1 INTRODUCTION

Information in this chapter addresses addenda, modifications, and corrections to the DEIS. This includes any additional information that was not included in the DEIS, modifications to information presented in the DEIS, and corrections to any erroneous information in the DEIS.

2.2 SUPPLEMENTAL INFORMATION

In this section, additional or more detailed information has been added to the FEIS to supplement the DEIS and address comments and information requests received during the public comment period on the DEIS. The information includes (1) additional information on project benefits and costs including cost by route option, (2) a comparison of cost and technical factors of alternatives, (3) additional information regarding undergrounding of transmission lines, (4) expanded explanation on elimination of BESS as an alternative to the Project, (5) update on beluga whales, (6) update on Kenai Peninsula brown bears and wolverines, (7) environmental cost/benefit analysis review summary, and (8) additional information on avian collision.

2.2.1 <u>Project Costs and Benefits</u>

The following information supplements the DEIS cost section (DEIS pages 1-31 through 1-32) and provides additional economic information for alternatives considered in detail.

Construction and Life Cycle Costs

The construction costs for the Project were estimated by Power Engineers, Inc. in 1996 and were updated in 1997/1998 (Power Engineers 1998) to reflect the facility requirements identified for the Project. The updated cost study also determined the present value of the operation and maintenance, and submarine cable replacement costs over the 40-year Project life. A discount rate of 4.5 percent was used as recommended by the Alaska Energy Authority (AEA) based on the long-term real cost of money (AEA March 1991). The results of this study are summarized in Tables 2-1 and 2-2 (pages 2-2 and 2-3) of the FEIS. For a description of the routes see Chapter 2, Sections 2.6.2 and 2.6.3 of the DEIS.

Construction Cost

To determine the construction cost for the Project, conceptual designs were prepared for each aspect of the Project and are documented in the *Power Engineers Cost Summary Report* (Power Engineers 1998). Determination of the construction costs included specifying typical overhead line structure types by line segment depending on expected weather and terrain conditions, and preparing preliminary layouts for the substation and cable transition stations. For the underground and submarine cable installations, typical cable sizes and installation techniques along with land and submarine ground or bottom conditions were reviewed as well. Where appropriate, vendor quotations for materials were obtained and combined with historical prices from actual projects. Estimated costs for the submarine cable and installation were compared to the actual bids received by CEA (January 1998) for replacement of their Knik Arm cables. Also included in the estimate were both winter and summer construction, and air support for transportation of personnel and materials.

TABLE 2-1
SUMMARY OF COSTS AND COST/BENEFIT RATIOS
(MILLIONS OF 1997 DOLLARS)

Routes	Constructed Cost	Present Worth of Operation and Maintenance Costs	Present Worth of Submarine Cable Replacement Costs	Total Life Cycle Costs	Cost/ Benefit Ratio*
Tesoro Route Alternative					
via Pt. Campbell Route Options A, D and N	$99.5	$4.3	$10.7	$114.5	1.25
via Fire Island Route Options A and B	$99.4	$5.4	$13.0	$117.8	1.22
Pt. Woronzof via Submarine cable direct Route Options A and C	$106.2	$4.7	$13.2	$124.1	1.16
Enstar Route Alternative					
Soldotna South/Alaska Railroad Route Options Es, F, H and K	$90.2	$6.1	$3.3	$99.6	1.44
Soldotna North/Alaska Railroad Route Options En, F, H and K	$89.7	$6.1	$3.3	$99.1	1.45
Soldotna South/Klatt Road Route Options Es, F, G and J	$90.1	$3.8	$3.5	$97.4	1.47
Soldotna North/Klatt Road Route Options En, F, G and J	$89.6	$3.8	$3.5	$96.9	1.48
Soldotna South/Old Seward Highway Route Options Es, F, I and M	$90.1	$3.6	$2.8	$96.5	1.49
Soldotna North/Old Seward Highway Route Options En, F, I and M	$89.6	$3.6	$2.8	$96.0	1.49

* Project benefits are $143.5 million from Table 1-11 in the DEIS.
Es – E South
En – E North

TABLE 2-2 SUMMARY OF LIFE CYCLE COSTS BY ROUTE OPTION[1] (MILLIONS OF 1997 DOLLARS)				
Route Option	**Constructed Cost**	**Present Worth of Operation and Maintenance Costs**	**Present Worth of Submarine Cable Replacement Costs**	**Total Life Cycle Costs**
A[2]	$47.4	$3.2	$0.0	$50.6
B	$52.0	$2.2	$13.0	$67.2
C	$58.7	$1.5	$13.2	$73.4
D	$41.9	$0.9	$10.7	$53.5
N	$10.1	$0.2	$0.0	$10.3
E North	$17.7	$0.6	$0.0	$18.3
E South	$18.2	$0.6	$0.0	$18.8
F[2]	$28.1	$1.7	$0.0	$29.8
G	$37.3	$0.9	$3.5	$41.7
H	$36.1	$0.8	$3.3	$40.2
I	$32.1	$0.8	$2.8	$35.7
J	$6.3	$0.7	$0.0	$7.0
K	$7.8	$2.9	$0.0	$10.7
M	$11.6	$0.4	$0.0	$12.0

1. So that the individual route option costs will add up to the overall cost for one of the Tesoro or Enstar alternatives, the costs are inclusive of all overhead line, land type underground cable, submarine cable, substation, transition station costs, and initial right-of-way costs occurring in a given route option. Environmental permitting and compliance monitoring costs are allocated across the route options.
2. Costs for Route Options A and F, common to the Tesoro and Enstar alternative routes, respectively, include required reactive compensation modifications at Dave's Creek Substation and the Bradley Lake to Soldotna Substation microwave upgrade (DEIS page 2-47) in the amount of approximately $6.5 million.

Operation and Maintenance Costs

Annual operation and maintenance costs were determined based on a typical program of annual maintenance for each type of facility, and the present worth was calculated over the life of the Project.

Submarine Cable Replacement Costs

Based on experience with submarine cables installed in the Knik Arm since 1967, CEA determined typical replacement intervals for submarine cables in that environment. The replacement intervals depend on whether the submarine cable is installed in an embedded or non-embedded configuration. The non-embedded configuration, in which the submarine cable is simply laid on the bottom, is used in locations where it is not practical to embed the cable. In the embedded configuration, the cable is physically buried in the bottom using special equipment. Based on discussions with CEA personnel, cable laying contractors experienced with conditions in the Knik and Turnagain arms, and bottom and side scan sonar surveys conducted along the proposed marine routes during the summer of 1996, appropriate replacement intervals for the Southern Intertie submarine cable were determined.

The cable replacement schedule for the non-embedded cables for Route Option C or D of the Tesoro Route is to replace two single-phase cables or one three-phase cable twice during the Project life (years 17 and 34), depending on the type of cable initially installed. Route Option B of the Tesoro Route has two submarine cable segments, one from Pt. Possession to Fire Island (Link T10) and one from Fire Island to Pt. Woronzof (Link T14). Link T10 from Pt. Possession to Fire Island extends out into the Cook Inlet where harsher marine conditions exist as compared to Route Option C or D. For Link T10, the cable would be non-embedded and the replacement schedule is to replace two single-phase or one three-phase cable three times during the Project life at 12-year intervals (years 12, 24 and 36). Marine conditions for Link T14 from Fire Island to Pt. Woronzof are such that the cables can be embedded, and so the cable replacement interval is one single-phase cable or one three-phase cable once during the Project life (year 30). For Route Option G, H, or I on the Enstar Route, the cable can be embedded for the entire distance and the cable replacement schedule for these routes is one single-phase cable or one three-phase cable once during the Project life (year 30).

Life cycle costs are the sum of the constructed cost, plus the present worth over the Project life of the operation and maintenance and cable replacement costs. The present worth of the Project benefits is the total from Table 1-11 of the DEIS. Benefit/cost ratios are calculated for the Tesoro and Enstar routes as shown in Table 2-1 (page 2-2) of the FEIS.

2.2.2 Cost and Technical Comparison Discussion of Route Options

The purpose of this discussion is to compare the various route option combinations for the Tesoro and Enstar alternatives, explain what combination of route options comprise a cost/technical preference for the Tesoro alternative and, separately, a cost/technical preference for the Enstar alternative.

Tesoro Route Alternative

The Tesoro Route alternative extends from the Bernice Lake Substation on the Kenai Peninsula to the Pt. Woronzof Substation in Anchorage. Route Option A, from Bernice Lake Substation to Pt. Possession, is common to all Tesoro Route alternatives. There are three route options for the remainder of the Tesoro Route alternative from Pt. Possession to Pt. Woronzof Substation that require an underwater crossing of the Turnagain Arm. The issues associated with the Turnagain Arm crossings vary significantly with each route option. Table 2-3 (on the following page) presents a comparison of the cost and submarine cable length for these route options. Following this table is a discussion comparing the route options with respect to cost, cable landing issues, marine issues, access for repairs, and an overall summary comparison of cost/technical factors for each option.

TABLE 2-3 TESORO ROUTE ALTERNATIVES PT. POSSESSION TO PT. WORONZOF SUBSTATION (MILLIONS OF 1997 DOLLARS)					
Route Options	**Miles of Submarine Cable**	**Constructed Cost**	**Present Worth of Operation and Maintenance Costs**	**Present Worth of Submarine Cable Replacement Costs**	**Total Life Cycle Costs**
Route Options D and N - via Pt. Campbell	13.9	$52.0	$1.1	$10.7	$63.8
Route Option B - via Fire Island	14.6	$52.0	$2.2	$13.0	$67.2
Route Option C - via Pt. Woronzof direct	17.2	$58.7	$1.5	$13.2	$73.4

<u>Cost</u>

As shown on Table 2-3, Route Options D and N would have the lowest total life cycle costs ($63.8 million) in comparison to Route Option B ($67.2 million) and Option C ($73.4 million).

Route Options B and D/N have the same construction cost ($52 million), despite the fact that Route Option B requires 0.7 more mile of submarine cable. This is because the added submarine cable cost is offset by the lower cost overhead line facilities that can be installed on Fire Island, as compared to Route Option N from Pt. Campbell to Pt. Woronzof Substation, which would be all underground cable on land. However, when submarine cable replacement costs are added, Route Options D/N have a lower life cycle cost than Route Option B.

Route Option C would require submarine cable for the entire distance from Pt. Possession to Pt. Woronzof. Because of this length of submarine cable, it is the most expensive route option.

On a cost basis, Route Options D and N are preferred because of the lower overall cost of these options, primarily due to the shorter submarine cable required.

<u>Cable Landing Issues</u>

The following are comparisons of submarine cable landing issues associated with Route Options D and N, B, and C. These discussions focus on the differences between landings at Pt. Campbell, Pt. Woronzof, and on Fire Island.

Pt. Campbell versus Pt. Woronzof Cable Landings

Cable landing issues are straightforward for the Route Option D landing at Pt. Campbell. Horizontal directional drilling techniques would be used to drill under the vegetated intertidal area and the low bluff on the northwest side of the point. From there the line would continue northerly underground with land type underground cable (Route Option N), terminating in the Pt. Woronzof Substation.

At Pt. Woronzof Substation a submarine cable landing is more difficult. A cable landing at Pt. Woronzof Substation would be required for Route Options B and C. Chugach has been installing submarine cables from Pt. Woronzof to Pt. Mackenzie across the Knik Arm at various times from 1967 until the most recent installation in 1999. Since that time, a large cable field has been constructed in the water off of the Pt. Woronzof Substation comprised of a total of 14 individual cables. In order to minimize the opportunity for damage to a single submarine cable, the individual submarine cables are installed separate from one another at distances from 70 to 200 feet. This results in the cables occupying a large area in the water (cable field) off Pt. Woronzof Substation. With respect to installation of the proposed Southern Intertie Project cables, it is not advisable to install submarine cables such that they cross one another in the water, as damage to both cables can occur during installation where the cables cross. Additionally, crossing the cables would preclude raising or retrieving the lower cable for repairs.

As a result, each submarine cable must be routed to the shore in such a way that the cables do not cross one another. Considering the existing submarine cables off the Pt. Woronzof Substation, this will require that the Southern Intertie Project cables make landfall on the south side of the sewage plant and then proceed underground inland and then north into the Pt. Woronzof Substation. A steeper bluff in this area will require a longer directional bore under the bluff than at Pt. Woronzof Substation. This reroute adds approximately $760,000 to the cost of landing cables at Pt. Woronzof Substation. The cost of this reroute is included in the costs for Route Options B and C. For either Route Option B or C, horizontal directional drilling techniques would be used to drill under the bluff to make landfall.

From a cable landing perspective, Route Option D to Pt. Campbell is preferred because of the relative ease of making landfall at Pt. Campbell and because of the inland approach to Pt. Woronzof Substation via Route Option N. The inland approach of Route Option N avoids conflicts with the existing cable field offshore at Pt. Woronzof Substation.

Fire Island Cable Landings

In all, Route Option B requires four submarine cable landings—Pt. Possession, two on Fire Island, and Pt. Woronzof. As a result, Route Option B is the least desirable option regarding submarine cable landings.

Marine Issues – Pt. Possession to Pt. Woronzof

The cable replacement intervals scheduled for each of the three route options (B, C and D) reflect the relative marine conditions expected for each of the submarine cable segments.

- Route Options C and D: Replace two single-phase cables or one three-phase cable twice during the Project life (years 17 and 34), depending on the type of cable initially installed.

- Route Option B: There are two submarine cable segments, one from Pt. Possession to Fire Island (Link T10) and one from Fire Island to Pt. Woronzof (Link T14). Link T10 from Pt. Possession to Fire Island extends out into the Cook Inlet where harsher marine conditions exist based on the 1996 bottom and side scan sonar surveys, as compared to Route Option C or D. For Link T10, the cable would be non-embedded and the replacement schedule is to replace two single-phase or one three-phase cable three times during the Project life at 12-year intervals (years 12, 24 and 36). Marine conditions for Link T14 from Fire Island to Pt. Woronzof are such that the cables can be embedded, and so the cable replacement interval is one single-phase cable or one three-phase cable once during the Project life (year 30).

Marine conditions are similar for Route Options C and D as they both follow approximately the same route across Turnagain Arm. Route Option D is preferred over Route Option C as the distance to be traversed by the submarine cable is much less (13.9 miles for D compared to 17.2 miles for C). Because submarine cable is quite expensive, the shorter the submarine cable distance the better the installation is from a construction/operations and life cycle perspective. This difference in submarine cable mileage required is primarily responsible for the added life cycle cost of $9.6 million for Route C over Route Options D and N.

As noted, marine conditions for Route Option B/Link T10 from Pt. Possession to Fire Island are considerably harsher than Route Options C, and D/N. Submarine cables in this link are exposed to high tidal currents and bottom scouring. To account for this difference in marine conditions, the cable replacement interval was adjusted to represent the costs that would be expected for that route option.

From a marine issues point of view, Route Option D to Pt. Campbell is preferred due to the relatively better marine conditions than for Route Option B, and because the length of submarine cable is much shorter than for Route Option C.

Access for Repairs – Pt. Possession to Pt. Woronzof

Reasonable access to the Southern Intertie Project facilities during the Project operating life is an important factor relating to how long it takes to identify problems, conduct repairs, and place the facility back into service. Submarine cable by its very nature poses more difficult access problems, as compared to accessing a transmission line on land. Additionally, repair or replacement of a submarine cable can require many months. Consequently, the shorter submarine cable crossing is preferred, retaining as much of the transmission line on land as is practical. From this perspective Route Options B and D/N retain more of the transmission line on land and are preferred over Route Option C, which is composed of all submarine cable.

Comparing Route Options B and D, the overhead line of Option B is located on Fire Island and is not as easily accessible as the underground line of Option N, which is located on the mainland between Pt. Campbell and Pt. Woronzof.

From an access point of view, Route Options D and N are preferred due to the shorter submarine cable length and the location of Route Option N on the mainland.

Tesoro Alternative Route Options Preference – Pt. Possession to Pt. Woronzof

A summary of the cost/technical factors for route options between Pt. Possession and Pt. Woronzof are shown in Table 2-4 (below). On an overall cost/technical basis, Route Options D and N are preferred over Route Option B or C. This results in a route preference for the Tesoro Route alternative of Route Options A, D and N extending from Bernice Lake Substation on the Kenai Peninsula to Pt. Possession (A), from Pt. Possession to Pt. Campbell via submarine cable (D), and from Pt. Campbell to Pt. Woronzof Substation via underground cable on land (N).

TABLE 2-4
TESORO ALTERNATIVE
COMPARISON OF COST/TECHNICAL FACTORS
PT. POSSESSION TO PT. WORONZOF SUBSTATION
(MILLIONS OF 1997 DOLLARS)

Turnagain Arm Route Options	Length of Submarine Cable	Total Life Cycle Costs	Cable Landings	Marine Issues	Access for Repairs	Cost/Technical Preference
Route Options D and N – via Pt. Campbell	13.9 miles	1st $63.8	1st	1st	1st	Preferred Route Option
Route Option B – via Fire Island	14.6 miles	2nd $67.2	3rd	3rd	2nd	–
Route Option C – Pt. Woronzof Direct	17.2 miles	3rd $73.4	2nd	2nd	3rd	–

Enstar Route Alternative

The Enstar Route alternative extends from the Soldotna Substation to the International Substation in Anchorage. Route option combinations are described below, followed by a discussion comparing route options with respect to cost, cable landing issues, marine issues, access issues, and an overall summary comparison of cost/technical factors for each option.

- On the Kenai Peninsula, two route options provide alternate routes from the Soldotna Substation to the southern end of Route Option F east of Sterling—Route Options E North and E South.

- Route Option F, which is common to all Enstar Route alternatives, extends through the KNWR to the south shore of Turnagain Arm.

- Three route options extend north from the south shore of Turnagain Arm at Burnt Island, across Turnagain Arm and through southern Anchorage to the International Substation. These options include G and J (via Klatt and Minnesota Drive), H and K (via Alaska Railroad), and L and M (via Old Seward Highway).

<u>Soldotna North and South Route Options</u>

From Soldotna Substation, Route Options E North and E South provide two options for reaching the southern end of Route Option F with overhead transmission lines. Table 2-5 below provides a cost comparison of the E North and E South route options.

TABLE 2-5
ENSTAR ROUTE ALTERNATIVES
SOLDOTNA NORTH AND SOUTH ROUTE OPTIONS
(MILLIONS OF 1997 DOLLARS)

Route Options	Constructed Cost	Present Worth of Operation and Maintenance Costs	Total Life Cycle Costs
E North	$17.7	$0.6	$18.3
E South	$18.2	$0.6	$18.8

The E North route option would require construction of an additional transmission line parallel to the existing transmission line corridor, extending north and east from the Soldotna Substation.

The E South route option would not require an additional transmission line to be added parallel to an existing transmission line. Instead, the existing 69kV transmission line would be rebuilt and converted for operation at 138kV. This existing 69kV transmission line connects the Soldotna and Quartz Creek substations. To maintain this connection a 138/69kV transformer would be installed at the proposed Naptowne Substation near the southern end of Route Option F.

The cost differential between the E North and E South route options is small. The E North route option would add a new transmission line to the existing corridor, resulting in a widening of that corridor. Consequently, the new line would conflict with existing land uses along the route. On the other hand, because the E South route option utilizes an existing transmission line, no new lines would be added and any conflicts with existing uses would be minimized. On this basis, Route Option E South is preferred.

Burnt Island to International Substation Route Options

From the southern shore of Turnagain Arm near Burnt Island to the International Substation there are three route option combinations. Table 2-6 below presents the costs for these three route options.

TABLE 2-6
ENSTAR ROUTE ALTERNATIVES
SOUTH SHORE TURNAGAIN ARM TO INTERNATIONAL SUBSTATION
(MILLIONS OF 1997 DOLLARS)

Route Options	Miles of Submarine Cable	Constructed Cost	Present Worth of Operation and Maintenance Costs	Present Worth of Submarine Cable Replacement Costs	Total Life Cycle Costs
Route Options G and J	11.2	$43.6 G - $37.3 J - $6.3	$1.6 G - $0.9 J - $0.7	$3.5 G - $3.5 J - $0.0	$48.7 - total G - $41.7 J - $7.0
Route Options H and K	10.5	$43.9 H - $36.1 K - $7.8	$3.7 H - $0.8 K - $2.9	$3.3 H - $3.3 K - $0.0	$50.9 - total H - $40.2 K - $10.7
Route Options I and M	9.0	$43.7 I - $32.1 M - $11.6	$1.2 I - $0.8 M - $0.4	$2.8 I - $2.8 M - $0.0	$47.7 - total I - $35.7 M - $12.0

Cost

Constructed costs for all three route option alternatives are similar, despite the shorter or longer submarine cable crossings required. This is because of the offsetting costs of the overhead lines required for each option in southern Anchorage. For example, Route Option M along Old Seward Highway requires a triple circuit steel pole structure capable of supporting 138kV and 34.5kV circuits, as well as distribution lines. This is more expensive than a single circuit 138kV line. Route Option K along the Alaska Railroad requires a section of underground land cable along the route near the Flying Crown Airstrip, at a higher cost than if that section were overhead.

Operation and maintenance costs for Route Option K are higher than for Route Option J or M because the Alaska Railroad charges an annual fee for the right-of-way. Route Option J or M are routed in public or acquired easements along streets, for which annual fees do not apply.

Submarine cable replacement costs are proportional to the length of the crossing of the Turnagain Arm.

Based on total life cycle costs, the combination of Route Options I and M cost less than the other two route option combinations. However, because the construction costs for each of the three route options are nearly the same, and the costs associated with operations and maintenance and submarine cable replacement are future costs and are thus more uncertain, none of the three route options show a clear cost advantage over the other.

Cable Landing Issues, Marine Issues, and Access Issues – G, H, and I

The three Enstar alternative route options for crossing the Turnagain Arm are all very similar and are not significantly different from one route option combination to another considering submarine cable replacement intervals, marine issues, cable landing issues, and access for repair. This is in contrast to the Tesoro Route alternatives where the various crossings of the Turnagain Arm exhibit significant differences from one route option to another.

For Route Options G, H and I on the Enstar Route, the submarine cable can be embedded for the entire distance across Turnagain Arm and the cable replacement schedule for these route options is one single-phase cable or one three-phase cable once during the Project life (year 30). Other than the length of the crossing, there are no significant differences between the route options related to cable replacement or marine issues.

Cable landings for Route Options G, H and I are similar in that each one will require that horizontal directional drilling techniques be used to bore under the vegetated portion of the intertidal area and/or the bluff in order to make landfall.

With regard to access for repairs, all three route option combinations are relatively equal, the only difference being the length of the submarine cable crossings. In southern Anchorage, the transmission lines along Route Options J, K and M are all equally accessible for repairs.

Enstar Alternative Route Options Preference

There is no strong cost/technical preference among the three route options for crossing the Turnagain Arm to International Substation. From a cost/technical perspective, an Enstar Alternative Route could be composed of Route Option E South from the Soldotna Substation to the Naptowne area, Route Option F through the KNWR, and then any one of the three route options to the International Substation in Anchorage (Route Options G/J, H/K, or I/M).

2.2.3 Underground Construction Costs

The purpose of this discussion is to provide additional information regarding the undergrounding of small sections of the Tesoro Route (Option A) and the Enstar Route (Option F) through the KNWR as requested in comments received on the DEIS.

Tesoro Route

Regarding undergrounding of short sections along the Tesoro Route north of Captain Cook SRA, the construction cost of 1 mile of overhead line in that area has been estimated to be approximately $600,000 per mile (Power Engineers 1998). To underground a 1 mile section, two transition stations would be required, as well as one circuit mile of underground cable installed in a duct bank casing pipe (see DEIS page B-26, Appendix B) and two or three concrete splicing vaults, depending on route conditions. The cost for undergrounding the 1-mile section is estimated to be $2.6 million. The ratio of underground to overhead costs is 4.3 to 1.

There are many factors that affect the cost of the installation. Typically underground cables are installed in the summer (DEIS page 2-50) as the cross linked polyethylene cable and accessories (splices and terminators) become stiff in the winter and more difficult to handle and install. North of Captain Cook SRA, construction is proposed to occur during the winter (DEIS page 2-50). While access will be easier in the winter because the frozen ground and snow cover would provide a good base for a snow road, winter construction will require (1) the adding of an antifreeze component to the concrete or slurry casing fill to prevent the slurry from freezing before it is pumped into the casing; (2) temporary heating of buildings or tents for cable reel staging to allow the cable temperature to rise to minimum installation temperature; (3) temporary high voltage alternating current (HVAC) equipment for use at the concrete vaults for cable splicing; and (4) more expensive excavation due to the frozen ground. Also, difficulty with backfilling and compaction due to the frozen material would be expected.

Enstar Route

Route Option F, composed of Links E8, E9, and E10, of the Enstar Route alternative crosses the KNWR from the Naptowne Substation siting area on the north side of the Sterling Highway to the south shore of Turnagain Arm, near Burnt Island. The added construction cost of undergrounding this section of the Project is about $70 million (DEIS page 2-23, Bury Line through KNWR). To expand on the DEIS description, Table 2-7 compares the various factors associated with operating and constructing an overhead line through the KNWR versus undergrounding the line. Type of facility, outage frequencies, repairs, construction cost, operation and maintenance costs, and life cycle costs are compared.

As shown in the table, the underground line is more expensive to construct than the overhead line ($19.8 million overhead versus $89.6 million underground). The same winter construction issues as discussed above for the Tesoro Route north of Captain Cook SRA also apply to the line route through the KNWR. While the underground facility has a lower outage frequency rate, the duration of the outages are much longer and the cost of repairs higher (operation and maintenance life cycle costs of $1.1 million overhead versus $2.2 million underground). Because of the high cost, undergrounding 138kV transmission lines is normally only considered for areas where overhead lines are not feasible due to public safety considerations, such as near airports or in the vicinity of high density developments, such as a downtown core area.

Repair of an overhead facility is relatively easy and repairs can normally be completed quickly, since all of the components are above ground and easily accessible. Underground facilities, in contrast, are primarily below ground and identification of the location, cause of the failure, and accessing the facility for repairs takes much longer. Additionally, an underground outage is generally longer in duration, in contrast to overhead lines where many outages are momentary (seconds or fractions of a second). This is why the industry average outage duration of 100 hours indicated in Table 2-7 below for underground outages, is much longer than for overhead. Overhead line outages, as indicated in the table, can be expected to vary from momentary, to minutes or a few hours. Another factor that would add to the complexity of operating an underground facility would be the remote location in the KNWR, and the average outage duration for a KNWR underground facility could reasonably be expected to be greater than the 100-hour average industry duration. Also, it should be understood that to support an underground cable installation across the KNWR, three above-ground reactive compensation stations, similar in appearance to a substation, would be required as part of the underground installation.

For all of these reasons, and particularly due to the high construction cost, placing the line underground through the KNWR is not feasible (DEIS page 2-23).

TABLE 2-7
COMPARISON OF OVERHEAD VERSUS UNDERGROUND THROUGH KNWR

Route Option F 38.5 Miles (62.0 kilometer)	Overhead Line	Underground Line
Facility Type (see Tables B1 and B2 in Appendix B of DEIS)	Link E8 – 33.1 miles Steel X Frame Structures Link E9 - 3.6 miles 1.0 mile - steel X frame structures 2.6 miles - single wood pole structures Link E10 – 1.8 miles Single wood pole structures	Links E8, E9 and E10 - 38.5 miles. Line would consist of 138kV solid dielectric XLPE cable installed in a duct bank-casing pipe. Three single-phase cables would be installed in the duct system with one additional spare duct. Splicing vaults would be installed every 1,500 to 2,500 feet depending on specific site conditions. Three reactor stations would be required with a 20 MVAR reactor installed in each station. The reactor sites are above-ground facilities that appear similar to a typical substation.
Relative Performance	Line is located in a Low/Moderate - snow/ice/wind area. Based on industry data indicating an average unscheduled outage rate of 1.8/100 miles/year**, typical performance would be 0.7 outages per year or 28 outages during the life of the Project. Outage duration would be from minutes to hours with most outages being short; for example, momentary outages resulting from icing or high winds.	Based on industry data indicating an average unscheduled outage rate of 0.34/100km circuit/year* (for all failure types), 8.4 outages of about 100 hours duration could be expected during the life of the Project. Approximately 70 percent of the outages would be due to internal component failure (cable, splice or termination). The remaining 30 percent are due to mechanical damage (dig-ins, etc.) and abnormal system conditions (lightning, etc.). Typically, failures or outages on underground lines are due to the failure of a component (splice or termination) and so are longer outages, rather than a momentary outage on an overhead line resulting from wind and/or ice on wires or structures. The 100-hour duration assumes that the necessary spare or replacement components are readily available near the site. If the replacement components need to be fabricated, then outage times can increase to several weeks or months.

TABLE 2-7 COMPARISON OF OVERHEAD VERSUS UNDERGROUND THROUGH KNWR		
Route Option F 38.5 Miles (62.0 kilometer)	**Overhead Line**	**Underground Line**
Expected Repairs	Because the line would be located in a Low/Moderate - snow/ice/wind area, and based on Chugach's operating experience with steel X frame and wood pole lines in Alaska, no long duration outages (24 to 72 hours) would be expected to occur during the 40-year Project life due to a structure failure. Normal maintenance would include tightening hardware and structure guying and occasional replacement of insulators, should one be damaged by gunshot for example. These types of problems would be identified through a regular line inspection program and repairs completed via helicopter during a scheduled outage.	For the 8.4 failures expected during the Project life, repairs would consist of replacing splices or pulling in new sections of cable into the ducts. For comparison purposes, assume that five failures will require replacement of deteriorated or failed splices or terminations and three failures would require replacement of one cable section (in this case a new cable would be pulled into a duct between pull boxes to replace the failed cable). In one case assume that the cable has failed such that the duct bank will need to be excavated and repaired, in addition to pulling in a new cable (this could occur due to frost heave, excavation, or catastrophic cable failure damaging the conduit). Splice replacement could be completed using helicopter access to the site. For replacement of a cable section or duct repair, ground equipment would be required in order to transport the heavier cable materials and excavating equipment to the site.
Construction Costs	$19.8	$89.6
PW O&M Costs	$1.1	$2.2
Life Cycle Costs	$20.9	$91.8

* F. Farnetti, B. Riot, G. Bazzi, and C. Morris, "Reliability of Underground and Submarine High Voltage Cables," CIGRE Study Committee 21 S 38-91, Symposium Montreal 1991.

** M. G. Lauby, K. T. Khu, R. W. Polesky, R. E. Vandello, J. H. Doudna, P. J. Lehman, D. D. Klempel, "MAPP Bulk Transmission Outage Data Collection and Analysis," compiled in *Applied Reliability Assessment in Electric Power Systems,* Edited by R. Billinton, R. Allan, and L. Salvaderi, 1991.

2.2.4 Battery Energy Storage Systems

The following is intended to clarify the explanation of why the BESS was eliminated as an alternative to the Project (DEIS pages 2-1 through 2-3). The reader is also directed to Section 1.3 of the DEIS (Purpose and Need for the Project) for a detailed discussion of each aspect of the purpose and need for the Project.

Table 2-1, Alternative Screening Summary (DEIS page 2-2), summarizes the alternatives considered but eliminated and whether each alternative meets the Project purpose and need screening criteria. Each alternative is denoted as to whether it would meet, partially meet, or would not meet the screening criteria. As indicated in Table 2-1 (DEIS page 2-2), a BESS would partially meet some of the screening criteria, but due to its limited storage capacity would only partially meet the purpose and need for the Project. For example, a BESS is designed to supply electricity to the system during an interruption for only 20 to 30 minutes. The BESS portion of Table 2-1 is shown below.

From Table 2-1, DEIS Page 2-2	
Alternative Screening Criteria for a BESS	**Meets Criteria**
Increase the reliability of the interconnected system	partial
Increase the power transfer capacity between the Kenai Peninsula and Anchorage	partial
Utilize the most economic generation mix to reduce costs	partial
Improve overall system stability during disturbances	partial
Reduce spinning reserve requirements	partial
Reduce transmission line losses	no
Reduce maintenance costs	no
Notes: yes = meets alternative screening criteria no = does not meet alternative screening criteria partial = partially meeting alternative screening criteria	

The reasons that a BESS would only partially meet the purpose and need for the Project are explained below, as they related to the Alternative Screening Criteria categories as shown in Table 2-1 above.

Increase the Reliability of the Interconnected System and Improve Overall System Stability During Disturbances

The use of a BESS as an alternative to the Project was studied in detail (Power Engineers 1997) (see Sections 1.3.1 and 1.3.4 in the DEIS). A BESS would only partially increase system reliability and stability. The benefit of the BESS is that during the first few moments of a system disturbance, a BESS would allow the system to continue to supply power to customers and would enhance the ability of the system to withstand the disturbance. However, the results of the Power Engineers study (1997) indicate that the BESS would introduce some instability into the system and increase the likelihood of the loss of the existing 115kV line, when the initial short circuit was on one of the other transmission lines. Additionally, once the 115kV line was lost, the Kenai Peninsula and Anchorage areas would become electrically separated and it could be necessary to drop customer load in one area or the other (load shedding) in order to avoid a blackout. As noted below, even with two BESS installed on the system, the secure power transfer capacity is still limited by system stability issues. So while the BESS would provide some partial benefits, it would not provide for the reliable and stable operation of the system at an increased power transfer capacity level.

Increase the Power Transfer Capacity Between the Kenai Peninsula and Anchorage

A BESS would only partially increase the secure power transfer capacity between the Kenai Peninsula and Anchorage (DEIS Section 1.3.2). The existing Quartz Creek transmission line is limited to transferring 70 MW of power for a secure transfer. To allow full use of the Kenai Peninsula generation, the secure transfer capacity needs to be increased to 125 MW (DEIS Page 1-8). The Power Engineers study evaluated a number of scenarios with a single BESS installed at various locations on the Kenai or in Anchorage, and also with two BESS's installed, one in Anchorage and one on the Kenai. In the cases evaluated with a single BESS installed on the system, the secure transfer capacity remained at 70 MW, limited by system stability issues. With two BESS's installed on the system, the secure power transfer capacity was increased to 90 MW. So while two BESS installations could partially increase the secure power transfer capacity, it would not increase the transfer capacity to the required 125 MW.

Utilize the Most Economic Generation Mix to Reduce Costs

Currently the existing system between the Kenai Peninsula and Anchorage is operated to maximize the transfers of economy energy, and coordinate the hydro and thermal generation resources on the Kenai Peninsula and in Anchorage, within the 70 MW limitation of the existing Quartz Creek transmission line (DEIS Section 1.3.3, Page 1-8). Standard utility practice is to determine generation requirements and operate individual generation plants in a mix in order to meet the instantaneous demand for power and produce the least cost power. The present limitation on power transfers between the Kenai Peninsula and Anchorage area results in a more expensive mix of power being generated from the existing power plants to supply the load than if the Project were in service (DEIS Page 1-23). As noted above, the BESS could only increase the 70 MW transfer capacity to 90 MW (with two BESS's), not the required 125 MW, and so would only partially allow the most economic generation mix to be utilized to reduce costs. However, an increased transfer over the existing line also results in higher transmission line losses, which would partially offset savings in generating costs. In addition, a BESS would add costs to the system due to the energy losses inherent in the charging and discharging cycle of the batteries. Another factor to be considered is that with a second transmission line in service, the most economic mix of generation units can be utilized, even if one line is out of service. A BESS does not provide this benefit.

Reduce Spinning Reserve Requirements

Spinning reserves respond to changes in consumer demand and failures in the generation and transmission system (DEIS Section 1.3.5). Spinning reserves improve reliability, but they are often expensive because some generation units must be operated partially loaded. The hydroelectric capacity at Bradley Lake on the Kenai Peninsula could provide a less expensive source for spinning reserves that otherwise would be provided by thermal generating units in the Anchorage area. Transmission capacity between the Kenai Peninsula and Anchorage is a constraint on the transfer of spinning reserves between areas with only the single Quartz Creek transmission line in service (DEIS Page 1-26). Approximately 30 MW of spinning reserve can be transferred from the Kenai Peninsula to Anchorage over the existing line. This transfer of spinning reserves results from the practice of distributing these reserves so that they are not all lost with a single event. With a second line in service, it is estimated that up to 50 MW of spinning reserves could be transferred from the Kenai Peninsula to Anchorage (Decision Focus 1996) (DEIS page 1-27).

A BESS located in Anchorage would contribute to spinning reserves in the Anchorage area. A BESS located on the Kenai would offset the spinning reserves already available from Bradley Lake. During an outage of the single 115kV Quartz Creek transmission line, a Kenai BESS could not supply spinning reserves to Anchorage, and Anchorage generation would have to provide spinning reserves the same as without a BESS. Only the installation of two BESS' would result in the ability to reduce spinning reserves across the system. However, as noted previously, the installation of a BESS on the system results in electrical system stability problems and adds costs to the system. Consequently, a BESS could only partially reduce spinning reserve requirements.

Reduce Transmission Line Losses and Reduce Maintenance Costs

A BESS is designed to provide electrical support to the system during a disturbance in order to compensate instantaneously for imbalances between generation and load (DEIS Section 1.3.6). However, a BESS can only be operated to support the system for a very limited period of time (20 to 30 minutes). During normal operating conditions, a BESS is essentially on standby and does not affect the flow of power across the system. Since transmission line losses primarily result from the steady flow of power along lines, a BESS would not reduce transmission line losses.

The reduction of maintenance costs is related to the planned maintenance of the existing Quartz Creek transmission line. Removing the line from service for reconstruction and conducting maintenance activities requires additional generation to be operated both on the Kenai Peninsula and in the Anchorage area to support the load, because with the line out of service generation resources can no longer be shared between the two areas. Because a BESS is designed to operate only during a disturbance and not to serve customer loads, the added generation resources would still have to be operated and a BESS would not reduce maintenance costs.

In summary, the use of a BESS as an alternative to the Project was studied in detail (Power Engineers 1997). Considering the results of the electrical studies, the BESS only partially meets the purpose and need for the Project and was eliminated as an alternative to the Applicant's proposal (DEIS Page 2-3). The cost of a BESS is also quite high. Typical costs range from $600,000 to $1,000,000 per MW, depending on how long the batteries must maintain the output and how often the batteries are cycled. Using this cost range, the cost of a single 40 MW BESS could range from $24 to $40 million.

2.2.5 Update on Beluga Whales

After the review of comments on the DEIS, NMFS was contacted in January 2002 to discuss beluga whale mitigation measures and construction timing in more detail. NMFS prefers a July-August construction season for the submarine cable crossings, since Spring (May-June) is the most sensitive time for belugas because of salmon runs and calving. The DEIS stated that construction would be avoided mid-June to mid-July. The construction season is now proposed during the July-August time frame. Construction could not occur during the winter months because of ice in Turnagain Arm. The new proposed construction season for submarine cable crossings will also comply with issues raised by ADF&G over conflicts with the hunting season in the Anchorage Coastal Wildlife Refuge, which begins September 1. Construction operations for cable laying will be completed prior to September.

The issue of beluga whale sightings during construction operations was also discussed. The cable laying portion of the two-month (July to August) submarine cable construction period would be two to four weeks, depending on the route selected. During this period there is the potential that the construction barge could encounter beluga whales. During the cable laying operation it would not be possible for the barge to stop engines upon the sighting of a whale, as the barge would drift and damage to the cable is likely to result. NMFS noted that the stop work request for belugas within 2,000 feet was a typical request; however, in the case of this type of operation the barge would be allowed to maintain course and speed unless a collision is eminent. The speed of the barge during cable installation operations varies depending on the type of activity. For cable laying without embedding the cable in the bottom, barge speed would typically be in the range of 1 to 2 miles per hour. For cable laying and embedding, the barge speed would be less than 0.2 miles per hour, and could be much slower depending on bottom conditions. Since this cable laying operation is not expected to have in-water noise other than the barge vessel and water jet excavation/trenching machine, NMFS was satisfied with the proposed plan of action.

2.2.6 Update on Kenai Peninsula Brown Bears and Wolverines

Brown Bear

Numerous comments were received regarding potential impacts to the Kenai Peninsula brown bear, and concerns raised by the Interagency Brown Bear Study Team (IBBST) regarding the Project. Impacts to brown bears are discussed in the DEIS, Section 3.5.3, Terrestrial - Wildlife, Brown Bears (pg. 3-60, 3-68); Section 3.5.4, Alternatives, Enstar to Chickaloon Bay - Route Option F, Brown Bear (pg. 3-90); Section 3.6.3, Alternatives, Enstar to Chickaloon Bay - Route Option F, Environmental Consequences (pg. 3-143); and Section 3.12.2, Cumulative Impact Process, Brown Bear (pg. 3-281), and Table 3-37, Cumulative Impact Analysis (pg. 3-295). As mentioned in the DEIS, Project consultants met with the IBBST over the course of the Project to review habitat assessment criteria and areas of particular importance regarding the Project (pg. 3-61, 3-62), and this information has been reflected in the impact assessment in the DEIS. Subsequently, in November 2001, the IBBST published a report titled *A Conservation Assessment of the Kenai Peninsula Brown Bear*. The report highlighted the following issues of concern:

- Population Parameters: a population census has not yet been conducted for Kenai Peninsula brown bears, although a DNA-based census is planned to begin in 2002. The estimated population of Kenai Peninsula brown bears is 250 to 300.

- Distribution and Movements: data show a trend that bears are located within 1 kilometer of freshwater during May to October as a result of the presence and abundance of salmon.

- Bear-Human Interactions: Reducing defense of life or property mortalities is a vital component of brown bear management. Bears near roads and trails are at a higher risk of being killed by humans. Any loss of female bears has a negative effect on the sustainability of brown bear population and is a critical concern for the wildlife managers. The brown bear model for cumulative effects found that human activities had reduced habitat effectiveness.

Wolverines

Wolverines were not selected as an evaluation species in the DEIS because it was assumed that potential impacts of the Project on this species would be similar to those for brown bear. However, comments on the DEIS have requested additional information on the potential impacts to wolverine specifically. The following additional information on the current status of the wolverine is provided below (Source: USFWS 2002. *Some potential effects of the Southern Intertie Project transmission line project's proposed Enstar Route on fish and wildlife habitats and populations on the Kenai National Wildlife Refuge*).

> "Lack of human access and the presence of large unfragmented "refugia" appear most important to maintaining wolverine population viability (Hatler 1989) and the character of wolverine habitat most readily apparent is its isolation from the presence and influence of humans (Banci 1994). The extirpation of wolverine through the eastern provinces of Canada and the Midwestern United States most likely coincided with the westward advancement of civilization (Banci 1994). Over-harvest and displacement by humans may have forced wolverine out of lowland habitats and into the more isolated tracts of its present day distribution. In British Columbia, female wolverines, unlike males, appear to avoid crossing large reservoirs and the Trans Canada highway (Krebs and Lewis 1998). Under heavy trapping or hunting pressure, wolverine populations can decline over a large area because of their naturally low density and reproductive potential (Magoun 1985). In Alaska, wolverine harvest has declined statewide by 38 percent over the last 20 years (Golden et al. 1993) and in northwestern Alaska harvest has declined 75 percent since the winter of 1977-1978.
>
> Wolverine population densities are naturally low and their homes ranges extremely large. In south-central Alaska, annual home ranges for males and postparous females were 535 and 105 kilometers squared, respectively (Whiteman et al. 1986). Wolverines in south-central Alaska utilized significantly different elevational strata during different seasons averaging 1,043 and 818 meters for April through October (summer) and November through March (winter), respectively (Ibid). It was believed that during summers wolverines fed on Arctic ground squirrels (*Spermophilus parryii*) and other small mammals and ground nesting birds. In winter, wolverines moved to lower elevations where they fed primarily on moose and caribou carcasses resulting from gray wolf kills

and starvation. In Alaska, Magoun and Copeland (1998) expressed concern for wolverine populations near large human population centers and recommended that land managers consider limiting wolverine harvests and reducing human disturbance in wolverine denning habitat. Banci (1994) and Landa (1997) recommended that protection for wolverines should be extended to travel and dispersal corridors between denning and foraging habitats.

On February 23-24, 1995 on the Kenai Peninsula, Alaska USFWS surveyed a 2,050 kilometers squared wolverine study area at the north end of the Kenai Mountains between Turnagain Arm and the Kenai River and between Quartz Creek/Six-Mile Creek valley and the foothills to the east of the Enstar gas pipeline (Golden 1996). The tracks of five individual wolverines were counted during the survey, which resulted in a calculated population size of 19.7 wolverines for a density estimate of 5.2 wolverines/1,000 km^2. This density was similar to densities of 4.7 to 5.2 wolverines/1,000 km^2 estimated during comparable surveys in the surrounding habitats of the eastern Talkeetna Mountains, northern Chugach Range, western Chugach Range, and the Chugach Mountains east of Anchorage.

Of significance to the proposed Enstar Route in regards to wolverines on the KNWR is the following information: (1) there is an estimate of wolverine densities, based on the best available wolverine aerial survey technique, in the mountainous, surveyed area east of the Enstar Pipeline (5.2 wolverine/1,000 km^2); (2) despite the relative higher densities of wolverine east of the Enstar Pipeline, few wolverines are harvested (7 in 27 years) or observed in the lowlands on the KNWR west of the Enstar Pipeline; (3) most of the wolverine harvest in GMU 15A has occurred along the Enstar Pipeline. The absence/scarcity of wolverines on the northern KNWR lowlands, despite relatively high moose densities and the availability of moose winter and wolf kills is difficult to explain. The dispersal of young female wolverines and their survival is likely the limiting factor in the recovery of vacant habitats (Bianci 1994:122). The fact that most of the wolverines trapped in GMU 15A are taken along the existing Enstar Pipeline corridor and few are taken over a huge area west of the corridor suggests that wolverines dispersing from relatively high density and presumably denning areas (Magoun and Copeland 1992) from the east to west, and wolverines seasonally moving from high to low elevations during the winter (Whitman et al. 1986) and during the trapping season, are subject to high trapping mortality rates along the Enstar Pipeline corridor. Making access along the existing Enstar Pipeline easier and more efficient by creating an additional and wider cleared right-of-way for the transmission line is not likely to decrease, but increase trapping pressure along a 20-mile front of the foothills where it is apparently intercepting dispersing and seasonal moving wolverines. At some future, but currently unknown, level of access and human use, the Enstar corridor could become a barrier to the movements of female wolverine (Krebs and Lewis 1999) and further decrease the opportunities for wolverine to colonize lowland habitat on the Kenai Peninsula."

2.2.7 Environmental Cost-Benefit Analysis Summary

The Issue

A number of reviewers for the DEIS commented that the cost-benefit analysis and socioeconomic impact assessment presented for the Project failed to account for impacts on various natural resources in the KNWR and other areas of the Kenai Peninsula. Some example comments included:

> *"The most serious inadequacy of the DEIS, from our perspective, is that neither the benefit/cost analysis or the socio-economic impact analysis makes any attempt to account for the loss of wildlife or outdoor recreation values."* (Anchorage Audubon Society, Inc., December 4, 2001)
>
> *"The most egregious example of problems with the benefit/cost analysis is that it leaves out the cost of any lost opportunities that the project will impose on the use of other resources, particularly wildlife and outdoor recreation."* (Anchorage Audubon Society, Inc., op. cit.)
>
> *"The DEIS fails to provide an economic cost-benefit analysis that thoroughly addresses long-term environmental costs, notably for loss of nationally and regionally significant wildlife, scenic values, eligible Wilderness areas in the Kenai National Wildlife Refuge, and outdoor recreation opportunities."* (Alaska Center for the Environment, December 5, 2001)
>
> *"Economic issues are dealt with insufficiently in the DEIS. There is no real cost benefit analysis of the proposed project in the DEIS. The DEIS does not take into account any of the costs associated with loss of habitat and impacts on wildlife…in the Kenai Refuge, in addition to others."* (The Wilderness Society, December 5, 2001)

These comments reflect on the scope of the economic and social impact investigations conducted for the Project. The reviewers contend that insufficient attention was paid to accounting for potential impacts on environmental resources and associated experiences, but which should nonetheless be incorporated into the balancing of costs and benefits by the Project's sponsors.[1] It follows that if the Project were to irretrievably degrade these wildlife and habitat resources, not only would the existence values be lost, but also the derivative economic values associated with consumptive use (e.g., hunting and fishing) or non-use, or passive use (e.g., viewing and recreation) of the resources. It is accounting adequately for these things that the reviewers say is lacking in the DEIS.

---

[1] In the economist's lexicon these are called "public goods"—things like air, wildlife, sunsets, etc.—which cannot be owned or rationed, and therefore do not have market values. Although there may be costs associated with gaining access to the resource, the actual consumption or experiencing of it is free.

The Southern Intertie Project's Cost-Benefit Analysis

A cost-benefit analysis (CBA) is an accounting tool. The purpose of CBA is to determine whether a proposed activity will yield more utility than that of the resources consumed in its implementation. Conventionally, the values of the resources consumed (costs) and useful goods and services produced (benefits) are denominated in terms of money. If the ratio of prospective benefits to projected costs is greater than unity, then the Project is deemed economically beneficial—i.e., society would get back more than it would have to give up to accomplish the objective, and it should be undertaken. By means of discounting, the values of projected future streams of income and outgo are brought back to the present and netted out to determine whether the net present value of the Project is positive or negative. If it is positive, then the Project's sponsors and investors are likely to commit to the action. If not, then they go back to the planning board and try to devise cost savings and/or benefits enhancements in the Project design.

The CBA presented in Chapter 1 of the DEIS analyzed the market-valued parameters of the Project. Construction and operating costs for the Tesoro and Enstar alternatives were compared to users' rate savings and other market-valued benefits of power supply reliability in the Rail Belt over the 40-year life of the Project. The resulting cost/benefit ratios were found to be positive, with or without the incorporation of a $48 million grant from the state.[2] The socioeconomic impact assessment of the Project in Chapter 3 commented on possible long-term impacts of the SIP on the regional economic benefits of tourism and recreation related to the Kenai Peninsula's natural attractions, but did not attempt a quantitative analysis owing to the Project's lack of obvious threat to the area's principal environmental attractions.[3]

Reviewing the cost-benefit analysis in Chapter 1 of the DEIS, Table 1-12 (page 1-31) shows the Enstar Route's benefit/cost (B/C) ratio equaling 1.44, based on a present value of costs of construction and operation of $99.6 million divided into total Project benefits of $143.5 million. The difference between total monetized costs and benefits—$43.9 million—represents the net value of the Project to the economy. Under cost-benefit accounting, that margin of net benefit could be traded off against losses in environmental asset values (however reckoned in monetary terms) up to the point where the cost/benefit ratio fell to unity. With a cost/benefit ratio less than 1.0, the Project would not be economically justified. The $43.9 million figure, however, is the present worth of the Project's net benefits over a 40-year period, and should be converted to an annualized value in order to be comparable to the valuation basis used to estimate environmental values. Using the Project's discount rate of 4.5 percent over 40 years, the annualized value of the Project's net benefits is $2.39 million. This is the value that could be used for the Enstar Route to

---

[2] The two sets of benefit/cost ratios cited in the text (Table 1-12, page 1-31) showed the B/C ratios for, respectively, the statewide economy and for the Project sponsors and investors.

[3] DEIS, p. 3-184: "Of itself, the Project would not seriously damage the area's tourist and recreation trade. It would not affect the majority of people using the area's fishing, hunting, camping and hiking resources. The red salmon run would still fill up every motel, resort, RV and bed and breakfast space every July. However, if people came to fear a "graffiti" effect, i.e., that one degradation of the setting leads to another and then another and another one after that, then perhaps a line would have be drawn on what additional changes to the landscape should be permitted. This would apply not only to essential infrastructure like roads and power facilities, but also to the borough encouraging development of subdivisions in remote areas like Gray Cliffs/Moose Point, where all the accoutrements of residential life would have to be inserted into a mostly undisturbed setting."

trade off environmental costs attributable to the Project to the point where the B/C ratio drops to unity.[4] Such a trade-off analysis is presented later in this discussion.

There are two aspects to the CBA debate that need to be addressed first, however: a practical and methodological one, and an institutional one. The methodological and practical issues concern the omission in the analysis of non-market-valued public goods which might conceivably be reduced by project alternatives—namely the non-use values associated with the existence, option and bequest values of wildlife habitat and animals and the passive uses of the setting in the form of wildlife viewing and outdoor recreation, and how to put them in the same ledger with the Project's measurable costs and benefits. This issue will be discussed at greater length in the following subsection.

The institutional aspect of the debate is even more fundamental: are the lead and cooperating agencies that are parties to the federal permit-granting action for the SIP required to include a completely quantified co-measurable cost-benefit analysis in their documentation and evaluation of the proposed action, including a dollar-denominated accounting of the non-use environmental values for natural resources that might be affected (notably wildlife habitat and animals in the KNWR)?

Addressing the permitting aspect first, federal agencies are required to evaluate the economic impacts of their regulatory actions under Executive Order 12866 (1993) and subsequent implementing rules from the Office of Management and Budget[5], as well as various administrative statutes. The Environmental Protection Agency has issued its *Guidelines for Preparing Economic Analyses* (last updated in September 2000), and individual agencies have promulgated their rules for complying with the order. In a survey of government use of cost-benefit analysis by the public interest research firm Resources for the Future, the authors noted:

> *"Currently, CBA is variously required, endorsed, circumscribed, or eliminated by statute. Agencies subject to OMB guidelines must use CBA unless a statute (or a court) requires otherwise, but there is considerable discretion in the guidelines as to how it is used. Therefore, the nature and extent of the use of CBA vary not only because of statutory provisions but for a host of reasons related to agency history, the training and interests of agency executives and staff, interpretations of statutory requirements, deadlines and resource constraints, and the like."*[6]

[4] The comparable value for the Tesoro route would be $1.58 million per year, based on net Project benefits over 40 years of $29.0 million. The annualized value is the annuity due each year to amortize the present value of the Project at 4.5% over 40 years.

[5] *Guidelines to Standardize Measures of Costs and Benefits and the Format of Accounting Statements* (OMB M-00-08, March 22, 2000). Under Section 12(a) of E.O. 12866, agencies are to "include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider…."

[6] Kopp, Raymond J., Alan J. Krupnick, and Michael Toman. *Cost-Benefit Analysis and Regulatory Reform: An Assessment of the Science and Art*. RFF Decision Paper 97-19. (Washington, DC, January 1997; page 45).

In the present action, the federal USFWS is not required to use a cost-benefit analysis in its Compatibility Determination for uses of the KNWR. Under the ANILCA of 1980, permitted uses of the land are described in qualitative terms, and the administrators of the Refuge are not obliged to consider monetary or economic factors in their consideration of applications for permits. The DEIS provides abundant documentation and expert judgment to the likely environmental impacts of implementing the proposed action, which the KNWR managers will incorporate into their decision-making.

The other two agencies party to the permit action—the RUS and the USACE—presumably could or would consider costs and benefits of the Project in their deliberations. In view, however, of the overarching scope of the USFWS's role in determining the permitability of either of the alternative alignments proposed for the SIP where they pass through the KNWR, the contribution would appear to be small that some dollar-denominated valuation of non-market environmental assets along the rights-of-way could make to the balancing decision process. In other words, one questions whether the decision-making process would materially benefit from an effort to assign monetary values to the environmental assets cited above.

The State of Environmental Cost-Benefit Analysis

In recent decades, concerns about environmental degradation and unsustainable rates of resource exploitation have led to attempts to incorporate the costs of losses of environmental quality and diversity into the Project feasibility calculus. The problem that confronts resource allocation decision-makers in their balancing of a project's costs and benefits is determining what weights to place on non-commeasurable values: how to weigh the dollar costs of manpower, materials and equipment consumed in the Project and the benefits of reliable electric power supply against losses in environmental values like wildlife habitat and species success or survival rates? Dollar-denominated things are easy to scale; the market generally does a good job in matching supply and demand at market-clearing prices. By virtue of their spending behavior, people reveal their preferences for how much and what quality of goods and services they need. But for resources that cannot be captured or harvested and sold, either because they are too elusive or impossible to confine or because it is against the law, the market does not objectively reveal people's preferences (or values) for them. Such resources have "non-use," or "passive use" values.[7] For these kinds of resources, one must somehow get people to state what their preferences would be, since they cannot be objectively revealed.

There are several approaches to valuing environmental assets. Where environmental assets can be used, in the sense that the user makes physical contact with natural resources (e.g., hunting, fishing, hiking, trekking, and other outdoors recreation based on undertaking activities in a given locale or setting), a proxy for the value of the resources is the sum of the expenses incurred to get there and carry out the activity. The "travel cost method" is a popular approach because people reveal by their expenditures and travel behavior what the particular experience is worth to them.

[7] Non-use values include the value of the existence of the resource, the option to use the resource at some future time, or the value of passing the existence values to future generations.

The values that result from this approach are considered as a lower bound of the range of possible use values, however, because the technique is not able to elicit how much a person might ultimately be willing to pay to experience the particular activity or preserve its existence.[8]

For non-use values, notably species existence and aesthetic features, their values must be defined indirectly, by means of hypothetical markets that seek to show how much utility (expressed in dollars) an individual would be willing to trade off in exchange for avoiding a postulated change in the quantity or quality (or both) of the natural resource or amenity. This is called "contingent valuation," where people's valuation of the resource is stated (by means of the survey) rather than revealed (through the marketplace). The notion of payment vehicle is central and critical, because to be valid the respondent in a contingent valuation survey has to believe that he or she would have to give up something of value (money) and therefore not have it to spend on something else in order to preserve the amenity. In such a survey, a large number of people believed to be neutral (unbiased) to the outcome of a resource allocation issue are surveyed as to how much they would be willing to pay to avoid some stated degree of loss of the resource (or, conversely, would be willing to accept in compensation for a postulated degree of loss). The results of the survey—e.g., the dollars per household that respondents would be willing to be taxed to preserve a certain natural resource—are subjected to statistical analysis and then extrapolated to the general population to yield a measure of the aggregate value of the potential loss to society. These values in turn would be incorporated into the formal cost-benefit analysis.

The economics literature is rife with debates over the validity of the contingent valuation method (CVM).[9] Various federal and state environmental protection and resource management agencies have approved use of CVM in cost-benefit analyses, although with strict instructions to deter introduction of bias into survey questions and interpretation of responses. Agencies and practitioners acknowledge that such surveys are lengthy and expensive, and that the results are narrowly applicable. In practice, regulatory agency use of cost-benefit analysis embodies an amalgam of monetary and non-monetarily quantifiable values where passive-use environmental assets are involved, in recognition of the uncertainty of validity of CVM results. Often, it is left to expert opinion as to what weights are to be assigned to environmental costs.[10]

---

[8] Some people are willing to pay more for a good or service than its current market price. The excess of a person's demand for some quantity of a good or service over its current price measures his/her willingness to pay to obtain the full value of the item. In economics jargon this extra margin of demand is called "consumer surplus," and in the case of environmental assets serves as a measure of the individual's willingness to pay for unpriced environmental services.

[9] See, for example, UCLA Department of Economics, *Recent Literature on Contingent Valuation Methods for Valuing Environmental Goods* at http://www.sscnet.ucla.edu/ssc/labs/cameron/nrs98/cvinv.htm (March 16, 2001); U.S. Environmental Protection Agency, *Guidelines for Preparing Economic Analyses*. EPA 240-R 00-003 (September 2000); Kopp, R.J., et al., *Cost-Benefit Analysis and Regulatory Reform: An Assessment of the Science and the Art.* Discussion Paper 97-19, Resources for the Future (Washington, D.C., January 1997); and Carson, R.T., et al., *Contingent Valuation: Controversies and Evidence*. Environmental and Resource Economics, 19: 173-210, 2001).

[10] Which often descends into a debate over whose expert is the most credible.

Examples of Economic Valuation of Wildlife Refuge Services

It might be useful at this point to cite some studies of environmental assets in Alaska. The Institute of Social and Economic Research (ISER), University of Alaska Anchorage, has a long record of applied research on the state's economic resources, some of which includes investigations of the economic value of wildlife refuges. Most pertinent to the Southern Intertie Project cost-benefit debate is *The Kenai National Wildlife Refuge: Economic Importance*, by Scott Goldsmith and Alexandra Hill (ISER, May 15, 2000, for the USFWS). Based on a 1997 survey of visitor spending for activities in the Refuge (denoted "On Site"—mainly recreational and sport fishing on the Kenai River) as well as for those dependent upon the Refuge's resources ("Refuge Dependent"—mainly for off-shore commercial fishing of salmon spawning on streams in the Refuge), and employing an input-output regional economic model of the Kenai Borough economy, the ISER study estimates the amount of employment and income in the borough in 1997 attributable to the Refuge.

During 1997 recreational visitors spent $21 million on trips to the KNWR for sport fishing and hunting, non-consumptive uses (e.g., hiking and wildlife viewing), and incidental use (where the visitors' primary purpose for the trip to the Kenai Peninsula was not to visit the Refuge). Another $28 million was spent for sport fishing trips to places not on the Refuge but where the target species were dependent on habitat provided by the refuge. Finally, about $23 million of the total of $58 million value of Cook Inlet commercial fisheries was estimated to be based on fish hatched and reared on the Refuge. In all, the gross sales value of activities associated with the KNWR amounted to an estimated $72 million in 1997. Quoting from the study:

> *"The total On Site economic significance of the Refuge is the same as the recreational On Site economic significance, because commercial fishing occurs off the refuge. This is 407 jobs (annual average) and $8.7 million in annul payroll. The total Refuge Dependent economic significance combines the jobs generated by refuge dependent recreational visits with those generated by the commercial fishery. This results in a total of 1,492 jobs and an associated total payroll of $40.4 million."*[11]

In sum, then, On Site and Refuge Dependent spending attributable to the KNWR generated the equivalent of 1,492 jobs and $40.4 million in labor income in the Kenai Peninsula Borough (annual averages, in 1997 dollars). These values represent, respectively, 5.67 percent of total borough employment and 5.72 percent of total borough labor income (salaries, wages, and self-employment earnings) in 1997.[12]

It should be noted that a portion of these jobs and earnings are based on Refuge-related recreational expenditures of borough residents, which represent about one-third of the total $49.1 million in On Site and Refuge Dependent spending, exclusive of commercial fishing receipts. It is the employment and income coming from the other two-thirds of the non-commercial fishing

[11] Op. cit., page 9.
[12] Op. cit., pp. A-4, A-6. Total Borough employment in 1997 amounted to 26,330 jobs, while total labor earnings amounted to $706.7 million.

money plus the commercial fishing receipts that support the growth of the local economy, being the purchasing power entering the local economy from outside rather than being recycled local earnings (which eventually diminishes due to leakages to savings, taxes, and imports of non-local goods and services). This distinction is important because it distinguishes the local economic *significance* of the KNWR from its economic *impact*. As the ISER study notes, "[w]hile economic significance looks at how much economic activity can be traced to the refuge, economic impact tries to estimate how much smaller the Borough economy would be if those activities could not take place. In some cases, if refuge activities were not available, the spending they generate would be displaced to other Kenai Borough activities, with little impact on total jobs and payroll. In other cases, the spending would occur elsewhere in Alaska or out of state. In those cases, the total Borough economy would be smaller."[13]

After netting out Borough residents' spending effects related to the Refuge, the net *impact* of non-local resident spending and commercial fishing for On Site and Refuge Dependent uses of the KNWR is estimated at 1,183 jobs and $33.9 million in annual labor income (or 4.5 percent of local yearly jobs and 4.8 percent of local earnings). Per the ISER study, these are the jobs and income in the Kenai Peninsula Borough that would be lost if the KNWR recreational and other attractions and amenities were no longer available.

The study goes on to point out that these values do not represent the totality of environmental-economic values associated with the Refuge, but rather that they provide a lower bound measure of its total value. The study did not attempt to compute the refuge's total economic value. Instead, it discussed the notion that some people would be willing to pay more than they actually did for their recreational activities, and that the total economic value of the refuge would be the sum of actual expenditures plus additional willingness to pay amounts. Also, the study discussed foregone opportunities of residents who were willing to accept lower incomes and reduced employment opportunities in order to live closer to the refuge, citing these as another component (albeit unquantified) of the economic value of the refuge. Finally, the study mentions that a portion of the value of the Cook Inlet fisheries harvest would accrue to the refuge as well as such non-use values as existence and option values for the wildlife. These extra-marginal values (i.e., amounts in excess of actual cash expenditures) are called the "net economic value" of the Refuge.

What dollar value could be assigned to this unaccounted-for net economic value? A similar study done of the Bristol Bay national wildlife refuges for the USFWS by ISER is instructive. This study, also conducted in 1997, looked at the economic significance, economic impact, and economic value of the Alaska Peninsula/Becharof National Wildlife Refuge Complex and the Izambek and Togiak National Wildlife Refuges.[14] For comparison, spending in, and deriving from, the three refuge areas supported about 3,225 jobs and $126.8 million in personal income in the Bristol Bay area versus the 1,492 jobs and $40.4 million in labor income accruing from the KNWR to the Kenai Peninsula Borough regional economy. The Bristol Bay refuges study states

[13] Op. cit., page 9.
[14] U.S. Fish and Wildlife Service. *Bristol Bay Economic Assessment Final Draft Executive Summary: December 3, 1998*.

that most of the net economic value of the Bristol Bay refuges is not in their consumptive use values but in their non-use values. The portion of the estimated net economic value of all the refuges' consumptive uses (e.g., subsistence fishing and hunting, and commercial fishing and processing) in 1997 was approximately $82 million—about two-thirds from subsistence activities and one-third from commercial fish harvesting and processing—but the non-use value of the refuges was put at $2.3 billion to $4.6 billion.[15]

A subsequent study by ISER for the Alaska Conservation Foundation[16] explains the methodology for the above estimate, and also provides a basis for extrapolating such economic valuations to other refuges. The $2.3 - $4.6 billion figure was based on a contingent valuation study that determined that U.S. households (which numbered about 92 million in 1997) would be willing to pay $25 to $50 per year, on the average, to preserve wildlife habitats in all of Alaska's refuges.[17] Updating the data to 2001, the analysis suggests that American households collectively value Alaska's conservation units (wildlife refuges) at $1.89 per household per million acres. Thus, on that basis, the annual non-use environmental value (i.e., net economic value) of the 152 million acres comprising all of Alaska's conservation areas is $29.65 billion.[18] It might be noted, in contrast, that the contingent valuation study done in 1992 for the *Exxon Valdez* oil spill yielded a willingness to pay for U.S. households of $3 per year (derived from a one-time payment of $31 to avoid another spill over a 10-year period), which extrapolates to a total value of $309 million for the environmental non-use values of the Prince William Sound region.[19]

On the basis of the $25 willingness to pay per household per year value from ISER's *Healthy Alaska Ecosystems* study, the net economic value of KNWR's 1.7 million acres would amount to approximately $330 million per year. Alternatively, at the $3 level per household expressed for the Exxon Valdez spill, the KNWR's net economic (i.e., non-use environmental) value would be about $40 million per year.

Another indication of the environmental value of the KNWR can be derived by combining the results of ISER's study of the Refuge's economic significance to the Kenai Peninsula Borough economy and a series of surveys and analyses by the ADF&G on the attitudes of a sample of Alaskan and non-Alaskan visitors towards wildlife.[20] ISER's KNWR study reported the number of recreation visits to the Refuge in 1997 and the amounts people spent associated with those visits. The ADF&G surveys included a set of contingent valuation questions designed to elicit statements of how much people would be willing to pay for a guaranteed view of various species of wildlife over and above the actual amounts expended on their trips. These data were used to

---

[15] *Bristol Bay Economic Assessment Final Draft Executive Summary: December 3, 1998.* Page 5.
[16] ISER, 2001. *The Economic Importance of Healthy Alaska Ecosystems*, by Steve Colt. (Anchorage, January 2, 2001)
[17] Op. cit. Table 22, p. 41. (Anchorage, January 2, 2001)
[18] Based on 103 million households in the USA willing to pay the lower bound value of $25 per household per year to preserve Alaskan wildlife refuges (op. cit., Table 23, p. 42).
[19] The product of 103 million households' average WTP of $3 per year. (op. cit., Table 23, p. 42).
[20] Alaska Department of Fish and Game: *Alaska Voters, Alaska Hunters, and Alaska Non-Resident Hunters: Their Wildlife Related Trip Characteristics and Economics* (ADFG, Anchorage, 1994), and Alaska Non-Resident Visitors: Their Attitudes Towards Wildlife and Wildlife Related Trip Characteristics and Economics (ADFG, Anchorage, 1997; both by SuzAnne M. Miller and Dr. Daniel W. McCollum).

estimate the net economic values that the sample of residents and non-residents placed on their wildlife-related trips to various regions of the state in the early 1990s. By multiplying the numbers of visitors to the KNWR by the net economic values estimated in the ADF&G studies, another rough indication of the non-use environmental value of the Refuge can be derived.

The ISER study of the KNWR reports a total of 292,114 visits to points inside the Refuge in 1997[21] plus another 250,192 to points outside the Refuge to fish for species dependent on Refuge habitats (mainly for salmon on the lower Kenai River). The ADF&G studies indicated that Alaskan residents on average valued the non-use environmental value of their wildlife-related trips to south-central Alaska destinations at about $185[22], while non-Alaskan visitors indicated an average value of about $400[23]. Considering just the visits to on-site locations in the KNWR, the aggregate net economic value that could be associated with the Alaskan residents visiting the refuge in 1997 (for whatever purpose) would be on the order of $43 million, while the non-Alaskan visitors' share amounted to about $24 million, for a grand total net economic value of $67 million.[24] This figure does not have a time dimension, being based on anticipated trip experience during one's lifetime rather than making an annual outlay (e.g., like an insurance premium) to preserve a resource. The annualized equivalent value of the $67 million net economic value would be $3.64 million per year, assuming an interest rate of 4.5 percent and a term of 40 years (the terms for the Southern Intertie Project's cost-benefit analysis). This is the amount that on-site visitors to the KNWR presumably would be willing to pay each year in excess of actual dollar costs of access to ensure the opportunity of viewing the various wildlife species living in the Refuge.

Following the foregoing computations, it would appear appropriate to add both the economic impact values (1,492 jobs and $40.4 million in annual labor income) and the value of the net economic benefits of the environmental assets of the Refuge to the cost side of the SIP's cost/benefit equation to see whether the ratio would remain positive after burdening the Project with the potential loss (i.e., cost) of the Refuge's environmental values. This would not be correct, however, unless some adjustments were first made to the value figures to exclude resources that would not be affected by the transmission Project. Only if it could be sustained that that the Southern Intertie Project jeopardized all of the environmental assets throughout the entirety of the KNWR would it be appropriate to charge the Project with the full net economic value (however estimated) of its environmental values. The Enstar alternative's routing would, however, affect only a narrow portion of the northern part of the KNWR, while the Tesoro Route alignment would affect virtually none of the KNWR. Some adjustment would need to be made to

---

[21] Sport fishing—85,890; big-game hunting—3,250; other hunting—6,000; non-consumptive uses (e.g., wildlife viewing, hiking)—16,974; and incidental visits (where the Refuge was not the primary purpose of the trip)—180,000, for a total of 292,114. Twenty-eight percent of the on-site visits were made by local (KPB) residents (82,146), while 51% were from other parts of the state (150,083), leaving 21% from non-Alaska residents (59,885). More than four-fifths of the fishing trips to refuge-dependent places outside the KNWR were made by Alaskan residents. ISER, op. cit, p. B-2.

[22] ADFG, 1994; weighted average derived from data in Table A-13, p. A-57. Net economic values varied by species, ranging from $86 for whales to $557 for grizzly bears. Different values were registered for trips to other areas, such as Southeastern Alaska, Interior Alaska, Arctic Alaska, etc.

[23] ADFG, 1997, Table C-3, p. C-23. NEVs ranged from $419 per trip to see eagles to $546 to see brown bears.

[24] Per breakdown of numbers of on-site visitors by place of origin in footnote 19.

exclude from the calculation base those portions and aspects of the Refuge that would not be affected by the Project. For example, the primary recreational use of the Refuge is sport fishing, most of which occurs on the Kenai River. The Enstar alignment's southern variant, which would cross the river at two points after departing the Soldotna Substation, would have at most a negligible aesthetic effect on fishing activities and none on the quality or viability of the habitat. Such non-consumptive uses as wildlife viewing and hiking in the Refuge would be affected only in the vicinity of the Enstar right-of-way (again aesthetically) most of which is remote from the usual locations of recreational activities in the Refuge.

This analysis thus frames the issue for proponents and opponents of the Project: (1) what is an appropriate basis for valuation of the Refuge's non-use environmental values at risk from the Project—i.e., what are people willing to pay to preserve its environmental assets from perceived risks? And, (2) what is the scientific basis for defining how much loss could occur out of the totality of the Refuge's environmental services to wildlife? What is the likely percentage? Unless the latter can be meaningfully described and quantified to an appropriate survey audience, a valid contingent valuation study cannot be done. And unless that can be done, a fully quantified economic-environmental cost-benefit analysis cannot be performed.

It is not being argued that the Project—particularly the Enstar alternative—would not have some impact on the environmental qualities of the Refuge. The crucial question is, of course, how much? In short, the economic and environmental values of the Refuge would have to be discounted to account properly for just the asset values that might be affected by the Project. The problem is that it is exceedingly difficult to quantify such risks as, for example, how much more vulnerable are the bears, moose, and other animals to human contact with the widened right-of-way versus with the existing condition. Can the biologists tell us with any certainty how the wildlife will respond to a given change in their habitat? Then, even if they can, how can that parameter be translated into terms that a lay respondent in a contingent valuation survey could relate to his or her sense of values and make reasonable, but still hypothetical trade-offs of giving up some purchasing power in exchange for an uncertain assurance that the money would guarantee the preservation of the habitat's viability? What is the significance of, say, a five or ten percent increase in the probability of bear-human encounters along the Enstar Route in the Refuge as a result of widening the existing right-of-way? What is the most likely number, and then what is the significance of that value in terms of the long-term viability of the bears (and other wildlife)? These are the kinds of information that have to be specified in a contingent valuation survey to elicit valid judgments.

Wrap Up and Conclusions

If the use and non-use values of the elements of the Refuge's environmental assets that would likely be irreversibly damaged by the Project amounted to at least $2.39 million per year (see page 2-30, above), then the Enstar Route alternative would have to be deemed unjustifiable from an economic efficiency standpoint. The question is, again, what is the appropriate value for the Refuge assets truly at risk?[25]

Both the proponents and critics of the Southern Intertie Project are faced with a dilemma over the accounting for the costs and benefits of the Project: how to fairly incorporate and reflect the values of environmental resources consumed or affected by the Project's construction and operating activities. On the one hand, the Project's sponsors have recognized the burdens their Project is likely to impose on the environment and have proposed mitigating measures (see DEIS Appendix D; the mitigation measures' costs are included in the cost-benefit analysis) to avoid or minimize adverse impacts. Thus, they have endeavored to identify and characterize the potential ecological impacts of the proposed action in the DEIS. Conversely, some commenters seek to prevent or minimize any adverse effects on the natural environment, and are disposed to oppose any disturbance to the natural setting—in particular that of the KNWR—in the belief that the equilibrium between the habitat and its dependents is very fragile and that any changes in the natural setting will set off irreversible damages. It follows naturally that the advocates of conservation will want to place as high a price as possible on the value of environmental services the Refuge provides to its occupants—animal and human—so that resource values will not be irretrievably disturbed or damaged by industrial intrusions like transmission lines.

The environmental economics profession has endeavored to bridge the divide by developing such tools as the contingent valuation method to facilitate evaluation of costs and benefits. But, as noted earlier, controversy still surrounds its employment. A perspective of the problem may be gained from considering a number of questions about how the Southern Intertie Project's cost-benefit equation might be broadened to include use and non-use environmental asset values:

- As discussed above, since the proposed action would involve only a small portion of the KNWR area, how much of the refuge-wide value of environmental assets (which, depending on the valuation methodology employed, could range from several tens of millions of dollars to several hundred million) should be included in the cost accounting? For example, salmon fishing on the Kenai River, which accounts for the majority of local and visitor visitation and consumptive recreational spending in the refuge, would be minimally affected by any of the proposed alignments and would have essentially no impact on the species' habitat. Are the environmental values associated with salmon abundance different from those for brown bears and moose?

- Is proportional acreage a suitable metric, or are there non-linear relationships between habitat disturbance and species viability that would alter the weighting? If so, how much, taking into consideration any differences in habitat characteristics in the transmission corridor versus elsewhere in the refuge?

- Is a Lower-48 dominated survey base for the contingent valuation analysis of the KNWR's environmental asset values necessarily the most suitable, and is it reasonable to

[25] Again noting that all of the Refuge's environmental values would not be at risk from the SIP, but only some portion of those in the vicinity of the right-of-way.

extrapolate the Refuge's constituency to the entire population of the United States? Should the views of Alaska's residents and actual visitors to the Refuge carry greater weight?

- Are the existing contingent valuation data applicable?

- If a contingent valuation survey was to be undertaken to support the Project's cost-benefit analysis, who would arbitrate the selection of consultants and design and testing of the survey instrument? (It is assumed that the environmental community would not accept the results of a survey that did not have their approval any more than vice-versa.)

These questions give a sense of the difficulties in accounting for non-market environmental values in cost-benefit analysis. Practical considerations precluded undertaking a survey of tourism and recreation and related environmental values on the upper Kenai Peninsula at the time the EVAL for the Project was being written, including deadlines on research, budget constraints, and—most importantly—keeping a perspective on the scope of the investigations relative to the scale of potential disturbances to the environmental setting. It must not be overlooked that there is an alternative to the Enstar Route that avoids the issues of passing through the Kenai National Wildlife Refuge. Except for a tiny parcel of land at the northern tip of the peninsula where the transmission line transitions from overhead to submarine, the Tesoro Route lies totally outside the Refuge and would impose no burden on its environmental values. The Tesoro Route was designated as the environmentally preferred alternative, and, in fact, its higher costs and lower benefit/cost ratio relative to the Enstar Route's reflect the incremental (i.e., mitigation) costs of avoiding the Refuge.

It is our opinion that the DEIS provides an adequate database for the permitting agencies to evaluate the relative costs and benefits of the Project, both monetary and non-monetary. Given the state of controversy over the validity of the contingent valuation method and the opportunities for biased results in any but the most extensive and expensive surveys, the scope and potential environmental impacts of the proposed project do not merit such an undertaking.

2.2.8 Avian Collision Mitigation

A specific comment on the DEIS suggested that the DEIS does not seem to take into account birds that use freshwater habitats during the day and raft in Cook Inlet at night. It was noted that during the winter, large rafts of resting waterfowl can be observed on Cook Inlet. These birds could be at special risk of collision with an overhead transmission line on the Tesoro Route because they are flying at dusk into a setting sun and may not be able to see the transmission lines. Following is a discussion regarding the potential for bird collisions on the Tesoro Route and the mitigation measures proposed to reduce the potential for avian collision.

The Tesoro Route is located between extensive wetlands to the east located on the KNWR and the shoreline of Upper Cook Inlet to the west. Although it seems to be logical that birds tend to move between the lakes and wetlands and the marine waters of Upper Cook Inlet, several environmental factors tend to discourage bird movement toward the inlet and across the Tesoro Route. Some of the major factors include:

- Most of the land west of the route is forested with only a few small ponds and wetlands or ponds between the route and the bluff along Cook Inlet.
- The shoreline of the upper inlet along this area supports essentially no salt marsh habitat, which might attract birds (National Wetlands Inventory maps).
- Marine waters of Upper Cook Inlet are subject to strong currents and high turbidity levels throughout the year and provide little habitat, if any, for waterfowl feeding or resting.
- Intertidal and subtidal invertebrates (sea duck prey) in the upper inlet along this area are extremely sparse due to the strong currents, ice scour, and very high turbidity (B. Driskell, Marine Biologist, WBD Associates, personal communications).
- The distance across open water to the wetlands on the other side of the inlet would tend to inhibit regular movement between these two areas (Bill Larned, Pilot/Biologist, USFWS, personal communication).
- Most birds are breeding during the summer months. Movements are generally restricted to more defined areas and most activities focus on nesting, brood-rearing, and molting.

Based on these factors, little movement of waterfowl would be expected across the Tesoro Route towards Cook Inlet at any time of the year.

During the winter months, ice is the dominant controlling force in the Upper Cook Inlet. Ice flows, cakes, and broken ice move back and forth with the tide throughout much of the winter. This regular ice cover in conjunction with the lack of feeding habitat for sea ducks would result in even less use (if any) by wintering sea ducks than during the summer. The ponds and lake on the KNWR would be frozen and there would be essentially no movement across the Tesoro Route during this time of year. The only wintering birds in the Upper Cook Inlet are the rock sandpiper and remain along the shoreline (Robert Gill, USGS, personal communication). Surveys of wintering sea ducks and other marine birds along the eastern shoreline of Cook Inlet generally do not encounter rafting sea ducks north of Ninilchik, in the Lower Cook Inlet, approximately 20 miles south of the Kenai River. However, wintering waterfowl (primarily goldeneyes, mergansers, and mallards) have been observed in ice-free portions of the Kenai River, and in Cook Inlet near the mouth of the Kenai River. Presumably these birds move between Cook Inlet and the river, although they would not be expected to routinely cross the proposed transmission line north of Nikiski (Bill Larned, USFWS, personal communication, 2002).

As discussed in Chapter 3 of the DEIS, Turnagain Arm is one of the main migration routes in this region and Chickaloon Flats is one of the primary staging areas in Turnagain Arm. Chickaloon Flats is approximately 5 to 20 miles east of the Tesoro Route. In spring, some migratory movements of birds could be expected between Chickaloon Flats and the Susitna River Flats on the west side of the Upper Cook Inlet. Portions of these birds would be expected to pass over the Tesoro Route at some location. Migratory movements are generally at a much higher elevation than local movements, except during inclement weather and poor visibility. No movement corridors have been identified for migrating birds across this portion of the route (Bill Larned, USFWS, personal communications, 2000). In winter, ice cover on freshwater lakes and ponds limits use of lakes and wetlands in interior portions of the peninsula. Concentrations of ice cover would be expected to associate with salt marsh habitats along the coast or river delta, and would tend to limit exposure to the transmission line. As a case in point, transmission lines at the head of Turnagain Arm (Quartz Creek Line) have not been identified as a collision hazard to migrating birds and are not marked.

During the breeding season, waterfowl and other waterbirds are dispersed throughout the areas. Nesting and brood-rearing and subsequent feather molt (flightless period) limit the movements of most birds. As young birds from the local population are beginning to fly in late summer (including trumpeter swans and loons), they become more vulnerable to collision with wires. Some species such as loon are more vulnerable due to their low flight patterns. Movement would be generally throughout the lakes and large wetland complexes east of the Tesoro Route. Transmission lines closest to water bodies or open wetlands would be expected to create the greatest obstacles. These lines would be marked within ¼ mile of these areas to increase the visibility, and the locations of these marked areas have been provided in the mitigation plan (see FEIS Volume II – Mitigation Plan).

During fall migration, Chickaloon Flats is also used for staging of waterfowl. Flight paths to the Chickaloon Flats coming from the west could potentially cross over the Tesoro Route along a broad front. Since the distance between the route and Chickaloon Flats is approximately 5 to 20 miles, the risk of collision would be expected to be quite low, except during adverse weather. Random local movement of waterfowl preparing for migration could come into contact with the lines, but marked lines would lower the potential for collision.

The effectiveness of marking the static line and conductors is highly dependent on the specific location and the type of marker used. Considering other transmission lines and distribution lines throughout the peninsula and their proximity to water bodies and wetlands, marking the lines on the Tesoro Route within ¼ mile of water bodies and open forest cover would be considered a conservative approach to reducing potential collision hazards to waterfowl.

2.3 UPDATED INFORMATION AND CORRECTIONS

The following are updated information and corrections to the DEIS organized by Chapter, Appendix, or Reference sections.

Chapter 3 – Affected Environment and Environmental Consequences

3.5.1 Terrestrial Vegetation

Table 3-3, pg. 3-36 – The marten should be removed from the table, as the marten is known to occur only in a limited portion of the KNWR. The arctic shrew should be removed from the table, as it does not occur on the Kenai Peninsula. The pigmy shrew and the common shrew should be included in this table rather than the arctic shrew.

3.5.3 Terrestrial – Wildlife

Table 3-7, pg. 3-57 – Collared pikas and Arctic ground squirrels should be removed from the table and corresponding text as they are not known to occur in the Project study area.

Pg. 3-58 – The Canada lynx is no longer a candidate species, but was officially declared a threatened species in the contiguous United States by the USFWS on March 24, 2000. In addition, it should be qualified that the lynx population was depressed in the 1980s. Closure of the lynx seasons from the mid-1980s to the mid-1990s on the Kenai Peninsula presumably allowed the lynx population to recover to natural but cyclic level by the mid-1990s.

Birds, pg. 3-64 – As a point of clarification, power lines constructed along the proposed Enstar Route pose a greater threat than the Tesoro Route to trumpeter swans because they are the largest-bodied bird using the Project area. Large bodied birds are more susceptible than small birds to power line collisions. Power lines along the proposed Enstar Route are a greater threat to trumpeter swans because of the documented trumpeter swan staging areas at the Lower Moose River and Watson Lake and their known migratory route that passes through Chickaloon Flats.

3.5.4 Alternatives

Tesoro Route – Bernice Lake to Pt. Possession – Route Option A, pg. 3-71 - Hunting and trapping also appear to be the main cause of mortality among <u>adult</u> lynx on the KNWR (Bailey et al. 1986) and trapping along the edge of a cleared power line right-of-way might increase trapping mortality as lynx move along the edge.

It is questionable that the clearing of the power line right-of-way would have any short-term or long-term benefits to snowshoe hares and lynx. This is because hares are reluctant to colonize areas with little protective cover from predators - protective cover that would be absent after clearing, then periodically removed to protect the power lines. In faster-tree-growing-areas of the southern boreal forest (Quebec), hares avoided clear-cut areas (similar to power line rights-of-way) for at least 10 years (Bellefeuille et al. 2000; Potvin et al. 1999). It was also concluded that it may take 30 years for hares to increase to peak densities in that environment (Ferron et al. 1998). That observation is supported by similar observations on the Kenai Peninsula. It took over 20 years for snowshoe hares to reach substantial population levels in the extensive 1969 burn on the refuge. Habitat structure is highly important to hares and a minimum lateral cover of 70 percent is recommended for suitable hare habitat (Litvaitis et al. 1985)—a value unlikely to be found in a power line right-of-way. It is likely that the power line right-of-way would be cleared at least once if not twice or more in 20 years, thus periodically removing any protective cover for hares.

3.5.8 Alternatives (Drainage Basins)

Chickaloon River Drainage Basin, pg. 3-109 – The gradient of 4.7 feet per mile listed in the DEIS is incorrect. The Chickaloon River has an average gradient of 25 feet per mile (4.7 m/km).

The estimated Chickaloon River salmon numbers in the DEIS are also incorrect. During investigation of the Chickaloon River, pink salmon was the most abundant salmon species with an estimated even year (1984) spawning escapement of 100,000 fish. Chinook salmon and sockeye salmon were estimated at 3,000 to 5,000 and 4,000 to 6,000 fish, respectively. No estimates were obtained for coho salmon or Dolly Varden.

Big and Little Indian Creek Drainage Basins, pg. 3-110 – The gradient for Big Indian Creek of 31 feet per mile listed in the DEIS is incorrect. The Big Indian Creek has an average gradient of 131 feet per mile (24.8 m/km).

In addition, the statement in the DEIS that both Little and Big Indian Creek "support small runs of chinook salmon" is incorrect. Big Indian Creek has spawning populations of Chinook, pink, sockeye, and coho salmon. Little Indian Creek supports coho and pink salmon. Populations in these streams have not been studied, so little is known of the run size or timing.

3.7.1 Affected Environment (Socioeconomic)

The following information updates DEIS Section 3.7.1 using the 2000 Census Data, which was not available at the time the DEIS was published. Tables from the DEIS have also been updated to include this information; table numbers are the same as those used in the DEIS for easy reference. This updated 2000 Census Data does not affect conclusions presented in the DEIS regarding socioeconomic impacts.

Socioeconomic Inventory

Updated demographic and economic information for the study area was gathered from these sources (in addition to sources listed on DEIS pg. 3-150):

- Municipality of Anchorage General Government Operating Budget, 2001
- Anchorage School District Financial Report, FY 2002-2003
- Kenai Peninsula Borough General Fund, FY 2000-2001

- Kenai Peninsula Borough School District FY01 Budget
- 1990 and 2000 U.S. Censuses of Population and Housing
- U.S. Bureau of Economic Analysis Regional Economic Information System (REIS) (2002)
- U.S. Bureau of Labor Statistics (2002)

Kenai Peninsula Borough

Demographic Summary

The population of the KPB has increased 22 percent since 1990, reaching 49,691 in 2000 (Table 3-11). Since 1990, the rate has been approximately 2.0 percent per year. Population estimates for the KPB are broken into two census subareas, the Kenai-Cook Inlet subarea and the Seward subarea, with the Kenai-Cook Inlet subarea accounting for 90 percent of the KPB population in 1999. Major population concentrations within the KPB occur in the City of Kenai (6,942), community of Sterling (4,705), City of Homer (3,946), City of Soldotna (3,759) and Nikiski (4,327).

TABLE 3-11 (Rev 2000)
KPB AND COMMUNITIES WITHIN PROJECT AREA
RACIAL COMPOSITION, 2000

	KPB	Kenai	Nikiski	Soldotna
Total Population*	49,691	6,942	4,327	3,759
White**	42,841	5,745	3,771	3,310
Black**	229	34	5	11
American Indian, Eskimo, Aleut**	3,713	607	327	187
Asian, Pacific Islander**	566	131	53	79
Other Race**	415	78	36	48
Two or more races	1,927	347	135	124

* Between 1990 and 2000, the KPB population increased from 40,802 to 49,691 (21.8%).
** Reporting one race.
Source: U.S. Census Bureau, "2000 U.S. Census of Population and Housing, Summary File 1-A (2001).

The population of Kenai has increased 6.3 percent since 1990, with an average annual growth rate of 0.9 percent. The City of Soldotna's population increased from 3,482 in 1990 to 3,759 in 2000. The fast-growing community of Nikiski had a 2000 population of 4,327, up 60 percent from 1990.

In 2000, the KPB had a total population of 49,691 of which 86 percent were white and seven percent were American Indian, Eskimo, and Aleut. In 1990, approximately 7.5 percent of the population was below the poverty level. Census 2000 data on income and poverty will not be available until mid- to late 2002.

Economic Summary

Total employment in the KPB was estimated at 27,236 as of 1999 (Table 3-14) (BEA 2002). The largest industries in terms of employment were trade (wholesale and retail) and professional services, which include health and education services. These two industries accounted for 45 percent of total employment in the KPB. The cities of Kenai and Soldotna showed the same pattern, with trade and professional services accounting for the most employment. Nikiski was different in that mining (oil and gas) accounted for the greatest employment, followed by trade and manufacturing.

The U.S. Bureau of Economic Analysis (BEA) employment estimates for 1990, 1995, and 1999 are presented in Table 3-14. BEA estimates that total employment in the KPB has increased from 22,328 to 27,236 over a nine-year period, an increase of 22 percent. Census 2000 data on local employment will be available mid- to late 2002.

TABLE 3-14 (Rev 2000)
KENAI PENINSULA BOROUGH EMPLOYMENT, 1990, 1995, 1999

Industry	1990	1995	1999	% Change 1990-99
Farm employment	129	97	92	-28.7%
Agricultural services, forestry, fisheries	2,498	2,014	2,666	6.7%
Mining	1,186	1,222	1,181	-0.4%
Construction	1,321	1,583	1,836	39.0%
Manufacturing	2,187	2,158	1,804	-17.5%
Transportation and public utilities	1,345	1,493	1,427	6.1%
Wholesale trade	484	556	596	23.1%
Retail trade	3,018	4,266	4,698	55.7%
Finance, insurance and real estate	1,053	1,109	1,319	25.3%
Services	5,251	6,293	6,989	33.1%
Federal government	760	849	815	7.2%
State and local government	3,096	3,757	3,813	23.2%
Total Full-time and Part-time Employment	22,328	25,397	27,236	22.0%

Source: U.S. Bureau of Economic Analysis, "Regional Economic Information Service." (2002). Includes farmers, proprietors, and self-employed.

The total personal income for the KPB in 1999 was estimated at $1.248 billion, according to the BEA. Per capita income was estimated at $25,478 for the KPB in 1999. Census 2000 data on local income will be available mid- to late 2002.

Housing Summary

According to the 2000 U.S. Census, the KPB had a total of 24,871 housing units, up from 19,364 in 1990. The City of Kenai accounted for 3,003 of the KPB's housing units, up from 2,681 in

1990. Soldotna had a total of 1,670 housing units, up from 1,457 units in 1990. The 2000 Census reported 1,766 housing units in the community of Nikiski, up from 1,009 in 1990.

Fiscal Summary

Total general government revenues totaled $56.61 million in 2001 (KPB 2002). Intergovernmental revenues accounted for 19 percent of total revenues, property and motor vehicle taxes accounted for 48 percent, and sales taxes accounted for another 23 percent. General fund expenditures totaled $60.17 million.

The Kenai Peninsula School District's total budget for Fiscal Year 2000-2002 amounted to $73.56 million, with property taxes and intergovernmental transfers providing the bulk of operating funds (KPB School District, 2002).

Municipality of Anchorage

Demographic Summary

The population of Anchorage has grown by 15 percent between 1990 and 2000, reaching 260,283 in 2000 (Table 3-16). Since 1990, the rate of growth has been approximately 1.4 percent per year.

TABLE 3-16 (Rev 2000)
HISTORICAL POPULATION ESTIMATES
ANCHORAGE AND KPB

Area	1980	1990	2000	% Change 1990-2000
Municipality of Anchorage	174,431	226,338	260,283	15.0%
KPB	25,282	40,802	49,691	21.8%
Kenai	4,324	6,327	6,942	9.7%
Nikiski	1,109	2,743	4,327	57.7%
Soldotna	2,320	3,482	3,759	8.0%

Sources: Alaska Department of Labor, Research and Analysis Section, Demographics Unit, 2002.
U.S. Bureau of the Census, Census of Population and Housing, 1980, 1990, 2000.

According to the U.S. Census Bureau, Anchorage had a total population 260,283 in 2000 of which 72 percent were white, 6 percent black, 7 percent American Indian, Eskimo or Aleut, 6 percent Asian or Pacific Islander, and 8 percent other (Table 3-18). Total personal income in Anchorage amounted to $8.717 billion in 1999, averaging $33,813 per person (BEA 2001).

TABLE 3-18 (Rev 2000) ANCHORAGE - MUNICIPALITY OF ANCHORAGE RACIAL COMPOSITION, 2000	
Total Population*	260,283
White	188,009
Black	15,199
American Indian, Eskimo, Aleut	18,941
Asian, Pacific Islander	16,856
Other Race	5,703
Two or more races	15,575
Source: U.S. Census Bureau, "2000 U.S. Census of Population and Housing" (2001).	

Economic Summary

Historical data on Anchorage employment are presented in Table 3-20. Employment has increased steadily from 1990 to 1999 at an average annual rate of approximately 1.36 percent. Over that time period, employment has increased primarily in services and trade while decreasing in federal employment and mining. Unemployment in Anchorage was estimated at 4.7 percent in 2000, slightly higher than the U.S. average rate of 4.0 percent. Between 1990 and 1995, the Anchorage rate was consistently lower than the U.S. average, after recovering from high unemployment during the late 1980s, but during the latter half of the decade the local unemployment rate rose slightly higher than the national rate (Table 3-21) (Bureau of Labor Statistics, 2002).

TABLE 3-20 (Rev 2000)
ANCHORAGE EMPLOYMENT, 1990, 1995, 1999

Industry	1990	1995	1999	% Change 1990-99
Farm employment	0	0	0	0.0%
Agricultural services, forestry, fisheries	2,201	2,066	2,455	11.5%
Mining	5,902	4,490	4,055	-31.3%
Construction	7,870	9,100	9,728	23.6%
Manufacturing	2,860	2,916	2,880	0.7%
Transportation and public utilities	12,535	13,777	16,146	28.8%
Wholesale trade	6,080	6,910	7,071	16.3%
Retail trade	23,968	28,070	29,754	24.1%
Finance, insurance and real estate	12,458	12,443	13,700	10.0%
Services	42,023	47,834	54,492	29.7%
Federal government	23,825	22,033	20,238	-15.1%
State and local government	15,890	17,120	17,704	11.4%
Total Full-time and Part-time Employment	155,612	166,759	178,223	14.5%

Source: U.S. Bureau of Economic Analysis, "Regional Economic Information Service." (2002). Includes farmers, proprietors, and self-employed.

The mining industry, including oil and gas, had the highest average monthly wage in the Anchorage area in 1999, at $7,485, and retail trade had the lowest average monthly wage at $1,704. The average monthly wage for all industries was $2,958. Table 3-22 lists historical wage information for Anchorage for 1990, 1995, and 1999.

TABLE 3-21
ANNUAL UNEMPLOYMENT RATE IN U.S., ALASKA, AND ANCHORAGE, 1990-2000

Year	U.S.	Alaska	Anchorage
1990	5.6%	7.0%	5.1%
1991	6.8%	8.7%	6.8%
1992	7.5%	9.2%	7.3%
1993	6.9%	7.7%	5.9%
1994	6.1%	7.8%	5.6%
1995	5.6%	7.3%	5.2%
1996	5.4%	7.8%	5.5%
1997	4.9%	7.9%	5.8%
1998	4.5%	5.8%	4.1%
1999	4.2%	6.4%	4.5%
2000	4.0%	6.6%	4.7%

Source: U.S. Bureau of Labor Statistics, 2002

TABLE 3-22 (Rev 2000)
ANCHORAGE AVERAGE MONTHLY WAGE BY INDUSTRY, 1990, 1995, 1999

Industry	1990	1995	1999	% Change 1990-99
Private Sector	2,446	2,595	2,791	14.1%
Agricultural services, forestry, fisheries	1,483	1,744	1,963	32.4%
Mining	6,239	7,199	7,485	20.0%
Construction	3,743	3,885	4,090	9.3%
Manufacturing	2,037	2,472	2,812	38.0%
Transportation and public utilities	2,940	3,459	3,674	25.0%
Wholesale trade	2,780	2,843	3,051	9.7%
Retail trade	1,457	1,507	1,704	17.0%
Finance, insurance and real estate	2,404	2,785	3,148	30.9%
Services	1,935	2,177	2,370	22.5%
Government Sector	2,960	3,443	3,577	20.8%
Federal	2,820	3,380	4,010	42.2%
State	2,911	3,366	3,061	5.2%
Local	3,182	3,588	3,595	13.0%
Total All Industries	2,658	2,789	2,958	11.3%

Source: Alaska Department of Labor and Workforce Development, Research and Analysis Section, "Employment and Earnings Summary Report, 1999."

Housing Summary

There were 100,368 housing units within the Municipality of Anchorage in as of the 2000 Census.

Fiscal Summary

Property and other local taxes provide the largest revenue source for the Municipality of Anchorage, making up approximately 53 percent of total government revenues (there are no sales taxes in Anchorage). Intergovernmental revenues accounted for 13 percent. Total general-fund revenues were estimated at $91.47 million for 2001 (Municipality of Anchorage 2002).

The Anchorage School District's budget for FY 2000-2001 totaled $448.66 million, with local property taxes covering 30 percent of the funds. Intergovernmental transfers provided much of the balance (Anchorage School District, 2002). The total assessed value of taxable property in the school district in 2000 was reported as $15.98 billion.

3.8.1 Affected Environment (Subsistence)

The following statement in the DEIS (pg. 3-206) is incorrect, and is deleted: "No specific designation has been made by the Federal Subsistence Board providing a priority to a particular group having customary and traditional subsistence practices in Unit 15A."

3.8.2 Environmental Consequences (Subsistence)

The statement found in the DEIS (pg. 3-209): "There appears to be no negative impact on populations of relevant species that would impair subsistence practices" is revised for purposes of clarity to the following: "Although the proposed project is likely to have adverse impacts on the moose population of the KNWR through impeded habitat improvement actions such a prescribed burning, it is not anticipated that such impacts to the moose population or other species will negatively affect subsistence opportunities on the refuge."

3.12.2 Cumulative Impact Process

Table 3-35, p. 3-288 Southern Intertie Project: planned or future projects 38.3 miles in length; 150 feet wide right-of-way; 696 acres of land used. Cumulative total of acres should be 129,283 acres.

Chapter 4 – Scoping, Consultation, and Coordination

4.6 Authorizations and Permitting Requirements

Table 4-6 Environmental Laws, Authority, and Related Statutes and Orders (pg. 4-23). Add: 16 U.S.C. 4601 et seq. Land and Water Conservation Fund Act of 1965.

4.6.2 Permits

In Table 4-7, pages 4-26 and 4-27, the correct address for DNR/Parks and Outdoor Recreation is 550 W. 7 Ave., Suite 1380, Anchorage, Alaska, 99501-3561.

Table 4-7 (pg. 4-26) National Park Service also administers the LWCFA in coordination with DNR/Parks and Outdoor Recreation.

Appendix B

pg. B-26 HVAC means high voltage alternating current.

References

Table 1-2, pg. R-1,	#8 should be Comprehensive Avalanche Atlas, Alaska Mountain Safety Center, Inc, October 1991 #9 becomes #10, so on up to #13 becomes #14